windynation

VertaMax

Power Inverter

PIN-1500-12M

PIN-3000-12M

User's Manual

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1 INTRODUCTION

The VertaMax Power Inverter is a highly reliable product that uses advanced technologies for high performance and stability. The VertaMax efficiently converts DC power from your vehicle, boat, or directly from a dedicated 12V DC battery, into 115V AC power that is commonly used in a wide variety of household AC items, such as computers, mobile phone chargers, radio, TV etc.

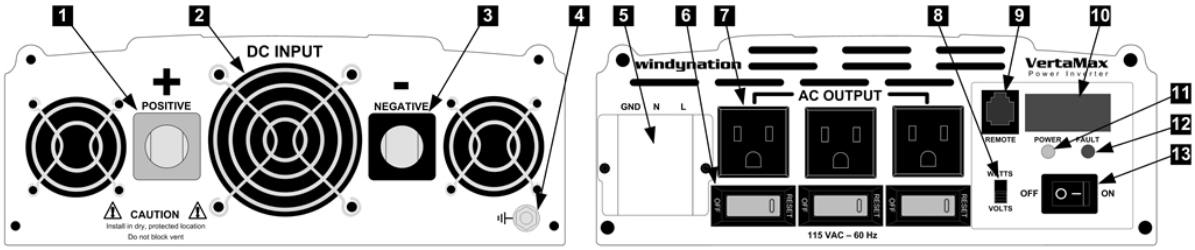
The VertaMax has many features that you would expect in very high end inverters as well as all the safety features that would be desired to protect your equipment.

The Inverter may be used for many different applications including Solar (PV) battery systems, Wind Turbine battery systems, Recreational Vehicles, Boats, etc.

Please read this manual carefully before installing or using the inverter and keep it for future reference. Microprocessor Based PWM (Pulse Width Modulation) Operation

1.1 FEATURES

- ✓ Microprocessor Based PWM (Pulse Width Modulation) Operation
- ✓ Three AC Receptacles with Circuit Breakers
- ✓ Soft Start
- ✓ Digital Display Voltage and Power Meter
- ✓ Power On/OFF Switch and LED indicator
- ✓ Remote On/Off Capability
- ✓ Automatic Overload Protection
- ✓ Low Voltage Shutdown Battery Protection
- ✓ Short Circuit Protection
- ✓ High Temperature Protection
- ✓ Fault Indication
- ✓ Load and Thermally Activated Cooling Fans



1	DC Positive (+) Input	8	Digital Display Select Switch
2	Cooling Fan[1]	9	Remote Switch Port[3]
3	DC Negative (-) Input	10	Digital Display Meter
4	Grounding Terminal	11	Power LED
5	Permanent AC Connection[2]	12	Fault LED
6	Circuit Breaker Protector [x3]	13	ON/OFF Switch
7	AC Outlets [x3]		

[1]Number of fans depends on model
[2]Not available on all models
[3]Optional Remote Cable required [PN: PIN-RMPS-01]

1.2 SAFETY INFORMATION

Please read the installation and operating instructions carefully prior to use. Pay special attention to the **IMPORTANT** and **WARNING** statements in the manual.

WARNING:
The VertaMax produces the same potentially lethal AC power as normal household outlets. It is suggested that you treat it with the same precautions as a normal 115 VAC outlet.

Do not operate the VertaMax near flammable fumes or gases, such as in the cabin of a gasoline powerboat, or near propane tanks.

Never work or service the AC wiring without disconnecting the DC Input connections.

Do not connect or disconnect batteries while the Inverter is operating from the battery supply. Dangerous arcing may result.

1.3 SPECIFICATIONS

1.3.1 Electrical Specifications

Parameter	PIN-1500-12M	PIN-3000-12M
Continuous Rated Power	1500 Watts	3000 Watts
Peak Surge Power	3000 Watts	6000 Watts
Input Voltage (Nominal)	12 – 13 VDC	
Input Voltage (Min – Max)	11 – 15VDC	
Output Voltage (Nominal)	115VAC	
Output Frequency (Nominal)	60 Hz	
Output Waveform	Modified Sine Wave	
Standby Current	≤0.80A	≤1.0A
Low Battery Voltage Alarm	10.5 VDC (+/-0.3VDC)	
Low Battery Voltage Shutdown	10.0 VDC (+/-0.3VDC)	
High Battery Voltage Shutdown	16 VDC (+/-0.5VDC)	
Efficiency	85-90%	

1.3.2 Physical Specifications

Parameter	PIN-1500-12M	PIN-3000-12M
Dimension (L x W x H)	13.0” x 8.7” x 3.0” (330mm x 221mm x 76mm)	16.7” x 10.3” x 3.7” (425mm x 262mm x 94mm)
Unit Weight	8.2 lb. (3.7kg)	15.4 lb. (7.0kg)
Cooling	Auto Powered Fan	
Operating Temperature	0°C to 60°C	
Storage Temperature	-25°C to 70°C	
Operating Humidity	20 to 80% relative humidity (non-condensing)	
Thermal Protection	>65°C	

2 INSTALLATION

- Insure all terminating connections are clean and tight to prevent arcing and overheating.
- The VertaMax must be installed in an area that satisfies all of the following conditions:
  1. Dry: Avoid any location where water can contact the inverter
  2. Cool: Ambient air temperature between 30°F and 105°F (0°C and 40°C)
  3. Ventilated: Allow at least 6 in (150 mm) of clearance above and below and at least 1 in (25 mm) on each side for proper air flow.
  4. Safe: Do not operate in a shared compartment with batteries or any flammable substances, (e.g.: gasoline)

IMPORTANT: To avoid fire, do not cover or obstruct ventilation openings.

2.1 ELECTROSTATIC (ESD) PRECAUTIONS

All electronic circuits may be damaged by static electricity. To minimize the likelihood of electrostatic damage, discharge yourself by touching an electrical ground (e.g.: copper pipe) prior to handling the unit and avoid touching components on the circuit boards. The risk of electrostatic damage is highest when relative humidity is below 40%.

2.2 MOUNTING

Mounting is optional for the VertaMax; however, the environment must be dry and protected from water.

1. The VertaMax can be mounted on a vertical or horizontal surface. If mounted vertically, the unit should be oriented such that neither end is at the top so foreign material cannot settle into the unit.
2. Install four user-supplied fasteners through the four inverter mounting slots and into the mounting surface.
3. Tighten all the fasteners to ensure the inverter cannot slide in any direction.

WARNING: Do not mount on flammable surface material.

2.3 GROUNDING

The VertaMax is designed to work with grounded electrical systems. In the inverter, ground is not connected to the input terminals.

Use a copper wire to connect the grounding terminal on the VertaMax enclosure to earth ground or chassis ground. The grounding terminal is located on the DC Input end of the inverter.

- Vehicle installations: Connect to the chassis of the vehicle.
- Boats installations: Connect to the boat's grounding system
- Fixed land based installations: Connect to earth ground

Do not connect the system negative conductor to this terminal. NEC requires the use of an external ground fault protection device (GFPD). The system electrical negative should be bonded through a GFPD to earth ground at one (and only one) location. The grounding point may be located in the solar/wind circuit or the battery circuit.

2.4 CONNECTIONS

WARNING: Electrical installations must meet local and national wiring codes, and should be performed by a qualified electrician.

WARNING: Do not connect the inverter and another AC source (such as a generator or utility power) to the AC wiring at the same time.

WARNING: Do not connect the inverter to an AC branch circuit that has high-power consumption loads. It will not operate electrical appliances that consume more than the units rated watts.

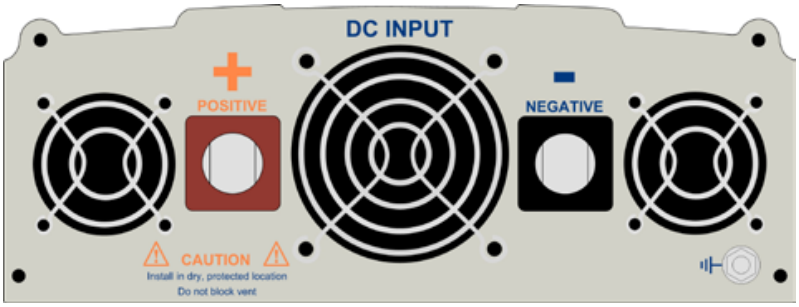
WARNING: Loose connectors result in excessive voltage drop and may cause over heated wires and melted insulation, which can lead to electrical fires.

WARNING: Reverse polarity connections (positive to negative) will blow internal fuses in the inverter and may permanently damage the Inverter.

IMPORTANT: The NEC requires that the wires carrying the system current never exceed 80% of the conductor's current rating (sizing recommendations are located in Section 4).

IMPORTANT: In addition to the protection provided by the Inverter's internal fuses, NEC requires a UL-listed fuse in the battery's positive DC cable as close to the battery as possible (sizing recommendations are located in Section 4).

1) The VertaMax has two DC terminals (one positive and one negative). The cables used for these terminals should be of equal length.



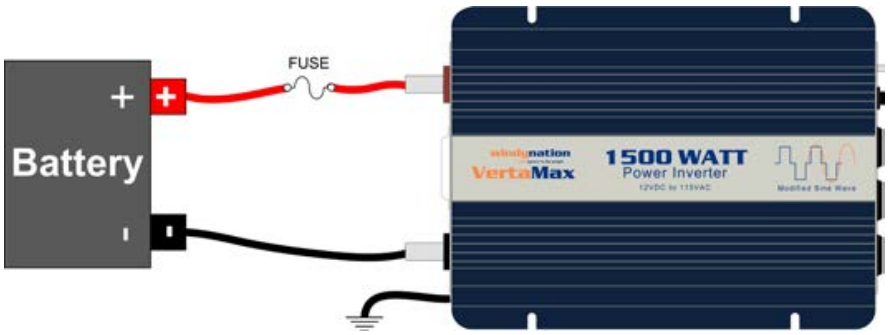
IMPORTANT: For 1500 Watt units, use a minimum of 4 AWG wire with a wire length not to exceed 4 feet*.

IMPORTANT: For 3000 Watt units, use a minimum of 1/0 AWG wire with a wire length not to exceed 4 feet*.

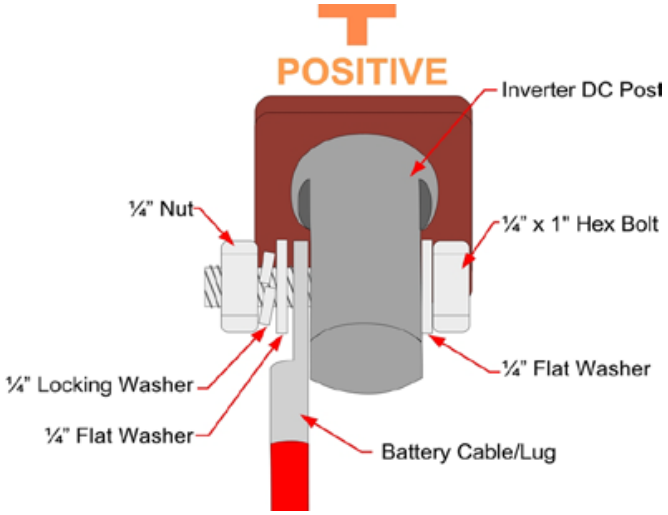
* For wire runs longer than 4 feet, consult a Wire Gauge Chart to safely determine what gauge of wire will be needed.

2) Prepare Cables to connect the power source to the inverter. The cables should be as short and thick as possible to reduce the voltage drop between the power source and the inverter as it draws current from the power source.
   a) Inverter end of the cable: Terminate copper wire with a 0.3125" diameter, tin-plated copper lug. It is recommended to cover the lug barrel with 1 inch of heat shrink tubing.
   b) Power Source end of the cable: Terminated with a lug or other connector that provides a secure, low resistance connection. For example, if the power source is a battery, the cable must be terminated with a battery terminal that clamps to the post on the battery.

   IMPORTANT: If there is an excessive voltage drop and the voltage at the inverter drops below 10 volts, the inverter will shut down.
3) Wire the positive cable(s) through user-supplied UL-listed fuse (e.g. Buss Fuse ANL-250 or equivalent) as shown below. The fuse should be as close to the battery as possible. The specific fuse ampere rating should be sized to allow operation of all your DC powered equipment but cannot exceed the maximum current (amp) rating of the inverter by more than 40%.



4) Be sure the inverter power button is in the 'OFF' position and the DC Power source is also off.
5) Connect the cable end with the 0.3125" lug to the Power Input Terminals on the DC Input end of the inverter as shown below. The red terminal is positive (+) and the black terminal is negative (-).
   Use ¼" Bolts, Washers, and Nuts (provided) and fully tighten the nut/bolt until the Cable Lug is secured.



IMPORTANT: When fully tightened, the Cable Lug should not be able to rotate around the Inverter connection post. Check and tighten the end caps periodically as they can become loose from vibrations or thermal cycling.

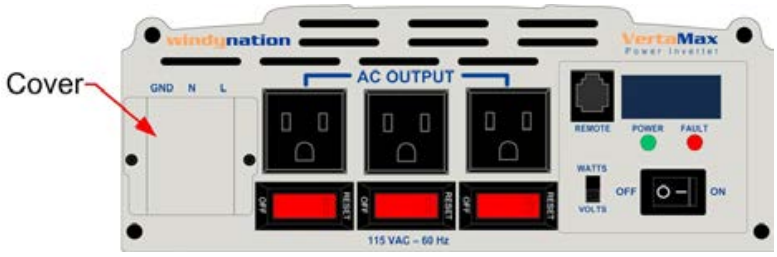
6) Connect cables to the power source:
   a) Connect the cable from the Negative (Black) Terminal of inverter to the Negative Terminal of the power source; ensure a secure connection.
   b) Connect the cable from the Positive (Red) Terminal of the inverter to the Positive Terminal of the power source (the battery's main fuse or the battery selector switch, if you are using one); ensure a secure connection.

2.4.1 Permanent AC Connection*

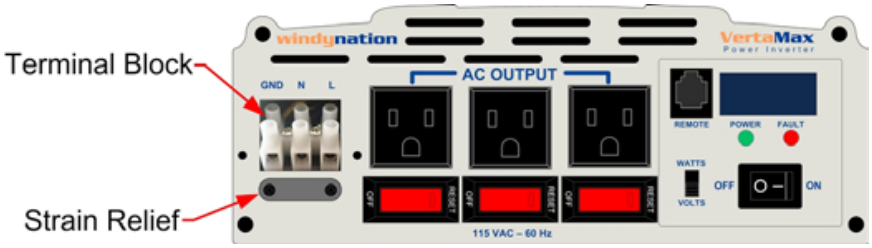
*Not available on all models

WARNING: If you are making a permanent AC connection to the inverter, make sure that the AC wiring is performed before any DC wiring is done. (DC hook-up may energize internal components and create an electrical shock hazard).

1. Remove the wiring compartment cover to expose the terminal blocks



2. Strip about 2" from the jacket of AC output cable
   a. AC output cable may be solid or stranded but must have three conductors up to 10AWG each
3. Strip approximately 3/8" off the insulation to expose the conductor
4. Run AC cable through the strain relief clamp and into wiring area



5. Insert the Ground, Line, and Neutral wires into the corresponding terminals

Label	AC Wire	Cable Color
GND	Ground	Green or bare copper
N	Neutral	White
L	Line	Black

6. Tighten the terminal block screws to 1.6lbf-ft
7. Secure strain relief clamp and check connections for correct polarity and no loose strands of wire
8. Connect the outgoing AC wires to the AC load panel

3 OPERATION

3.1 POWER

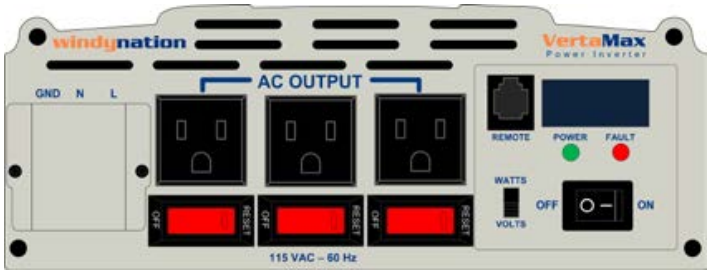
The VertaMax features a Soft Start to handle the power surge that is created when some appliances are turned on. This feature helps protect both the appliance and the inverter from excessive power draws and surges.

When the power switch is turned on, the VertaMax Soft Start will smoothly bring up the AC power. The Soft Start circuitry also activates under excessive loads and short circuits, to quickly turn off power to protect the device and the inverter. Soft Start will attempt to smoothly bring up the AC power, unless it detects an excessive load.

3.1.1 Power ON

Ensure the VertaMax is properly installed and connected as shown in Section 2 and ensure the DC Power Source is ON (if switched).

From the AC Output end of the inverter, switch the rocker power switch to the ON position. The green power indicator will light and the VertaMax will now deliver AC power to the outlet(s) on the AC Output end of the inverter.



Plug the AC product(s) you wish to operate into the AC outlet(s) and switch them on, one at a time.

IMPORTANT: Do not turn on all AC products at the same time and turn on the larger power product first.

IMPORTANT: In the ON position, even if no loads are connected, there is a low current draw (<1A).

3.1.2 Power OFF

From the AC Output end of the inverter, switch the rocker power switch to the OFF position to shut down the Inverter completely, preventing it from drawing power from the batteries. The green power indicator will go out.

This will also “reset” the unit if it shuts down due to low battery or overload.

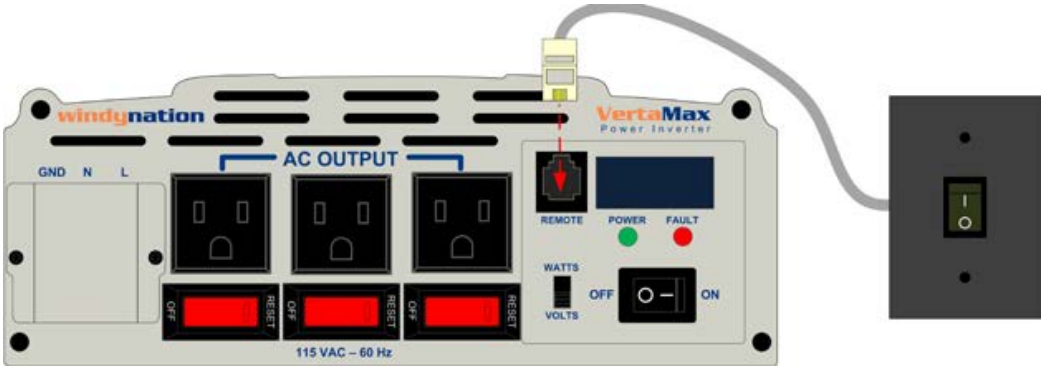
3.1.3 Remote ON/OFF (optional)

The VertaMax is equipped with a remote port, that when used with the optional Remote Power Switch[1] will allow you to turn the power inverter **ON** or **OFF** remotely when the inverter is installed in an out of reach location.

[1]Remote Power Switch: Part Number PIN-RMPS-01 (purchased separate) is a 5 meter corded remote control available through Windy Nation.

To remotely control the power function of the inverter, switch the rocker power switch (on the inverter) down to the OFF position, essentially shutting down the Inverter. From the Remote Control press the “ON” button to turn the inverter on and the “OFF” button to turn the power off.

IMPORTANT: Although the main power rocker switch will be in the OFF position, the green power indicator will work as normal operation and will light when the VertaMax is remotely "ON".



3.2 Meter Readings

The VertaMax is equipped with a digital meter on the AC Output End of the unit. The meter will provide one of the following measurements, depending on the switch selection:

1) WATTS: AC output power; shown in Watts
2) VOLTS: DC input voltage of the batteries; shown in Volts DC

3.3 Protection – Alarms

The VertaMax has several protection features to protect itself as well as your electrical system.

3.3.1 Over Input Voltage

When the DC INPUT power voltage exceeds 16V DC, the alarm will beep three (3x) times and the FAULT LED will blink Red.

The inverter will automatically shut down to protect itself from excessive input voltage.

IMPORTANT: Although the inverter incorporates protection against over-voltage, it is still possible to damage the unit when the input voltage exceeds 15V DC.

3.3.2 Low Input Voltage

As a battery is used, its voltage begins to decrease. When the inverter senses that the voltage at its DC input has dropped to 10.5V ± 0.3 DC, an audible alarm will sound and operation will remain normal. When this happens, it is important to remove or shut down computers or other sensitive devices that may be connected to the VertaMax and recharge the battery before its capacity drops too low. The inverter can operate while the battery is recharging.

If the audible alarm is ignored and the voltage drops to 10.0V DC, the alarm will beep three (3x) times, the FAULT LED will blink Red, and the inverter will automatically shut down to protect the battery from being over-discharged.

When the input voltage rises to approximately 11.4 – 11.9V DC, the inverter restores to normal operation and the red FAULT indicator will turn off.

3.3.3 Power Overload

When the starting power exceeds the rated surge power or the AC appliances connected to the VertaMax exceed the inverter's power rating, the alarm will beep continually and the FAULT LED will blink Red. The output voltage will decrease and the inverter will automatically shut down after approx. 20 seconds.

When in over current protection mode, the inverter cannot automatically restore to normal operation; reset to normal operation by using the manual power switch.

3.3.4 Over Heating

When the inverter exceeds a safe operating temperature, due to insufficient ventilation or an increase in ambient temperature, the alarm will beep two (2x) times and the FAULT LED will blink Red. If the over-temperature condition persists, the inverter will automatically shut down.

The inverter's cooling fan(s) are temperature controlled and only activate when the inverter is approaching an unsafe operating temperature

When the temperature drops, the inverter will automatically return to normal operation.

Important: The cooling fan is designed to operate when the temperature increases but may not be adequate enough to prevent overheating.

3.3.5 Short Circuit

This inverter is equipped with multiple internal fuses. When in a short circuit state, the alarm will beep and the FAULT LED will blink Red. The inverter will automatically shut down after three (3) seconds.

3.3.6 Functional Matrix

Operational Mode	Power Switch	Power Light	Fault Light	Audible Alarm
Unit is off	Off	Off	Off	Off
Normal Operation	On	On	Off	Off
Low input voltage, <11V	On	On	Off	On
Low input voltage, < 10.5V	On	On	On	On
Low input voltage, < 10.0V	On	Off	On	On
High Input voltage, > 15V	On	On	On	On
High Input voltage, > 16V	On	Off	On	On
Over temperature or overload	On	Off	On	On
No 12V DC input	On	Off	Off	Off

4 APPLICATION

4.1 Power Consumption

For each piece of equipment you will be operating from the inverter, you must determine the battery's reserve capacity (how long the battery can deliver a specific amount of current – in automotive batteries, usually 25 ampere) or ampere-hour capacity (a measure of how many amperes a battery can deliver for a specified length of time).

Example – Reserve capacity: a battery with a reserve capacity of 180 minutes can deliver 25 ampere for 180 minutes before it is completely discharged.

Example – Ampere-hour capacity: a battery with an ampere-hour capacity of 100 ampere-hours can deliver
5 ampere for 20 hours before it is completely discharged.

To determine the battery ampere-hour capacity:

1) Determine how many watts each piece of AC equipment (TV, light bulbs, etc) consumes. This can normally be found on the product label. If only the current draw is given, multiply the current draw by 115 to get the watt consumption.
2) Estimate the time (in hours) that each piece of equipment will be running between battery charging cycles.
3) Calculate the total watt-hours of energy consumption (power in Watts x operating time in hours) using the average power consumption and the total estimated running time (in hours). Power x Operating Time = Watt-Hours.
4) Divide the watt-hours by 10 to determine how many battery (12 volt) ampere-hours will be consumed.

4.2 Typical Power Consumption

Appliance	Watts
Stereo	200
Table Fan	200
TV	250
Small Refrigerator	350

Appliance	Watts
Microwave - 1000 W	1000
AC (5,000 BTU)	700
Computer	300
Hair Dryer	1000

Hand Drill - 1/2"	600
Light Bulb - 100 W	100

Coffee Maker	1200
Blender	400

4.3 Wire Gauge Reference

4.3.1 Ampacity Table

Cable Length (feet)	Load Amperage – Power @ 12VDC												
	10A 120W	20A 240W	30A 360W	40A 480W	50A 600W	60A 720W	70A 840W	80A 960W	100A 1200W	120A 1440W	160A 1920W	200A 2400W	250A 3000W
2	16AWG	16AWG	14AWG	12AWG	10AWG	8AWG	8AWG	6AWG	4AWG	2AWG	2AWG	2/0AWG	3/0AWG
4	16AWG	16AWG	14AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	2AWG	1AWG	2/0AWG	4/0AWG
6	16AWG	14AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	2AWG	2AWG	1/0AWG	3/0AWG	4/0AWG
8	16AWG	14AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	2AWG	2AWG	1/0AWG	3/0AWG	4/0AWG
10	16AWG	14AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	2AWG	2AWG	1/0AWG	3/0AWG	4/0AWG
12	14AWG	14AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	2AWG	2AWG	1/0AWG	3/0AWG	4/0AWG
16	14AWG	12AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	2AWG	2AWG	1/0AWG	3/0AWG	4/0AWG
20	14AWG	12AWG	10AWG	8AWG	6AWG	6AWG	4AWG	4AWG	2AWG	2AWG	2/0AWG	4/0AWG	4/0AWG
24	12AWG	12AWG	10AWG	8AWG	6AWG	4AWG	4AWG	2AWG	1AWG	1AWG	2/0AWG	4/0AWG	4/0AWG
28	12AWG	10AWG	8AWG	8AWG	6AWG	4AWG	4AWG	2AWG	1AWG	1AWG	2/0AWG	4/0AWG	4/0AWG
33	10AWG	10AWG	8AWG	6AWG	4AWG	4AWG	4AWG	2AWG	1AWG	1AWG	2/0AWG	4/0AWG	4/0AWG
42	10AWG	8AWG	6AWG	6AWG	4AWG	4AWG	2AWG	1AWG	1/0AWG	1/0AWG	3/0AWG	4/0AWG	NR
50	8AWG	6AWG	6AWG	4AWG	4AWG	2AWG	2AWG	1AWG	1/0AWG	1/0AWG	3/0AWG	NR	NR

NOTE: Applicable to conductors: Rated 0 through 2000 Volts with an ambient Temperature of 30°C (86°F)

4.3.2 Wire Thickness

AWG	Diameter inches (mm)	Ohms per 1000ft	Break Force	Square mm2
16	0.051 (1.29)	4.016	75 lbs	1.30
14	0.064 (1.63)	2.525	119 lbs	2.08
12	0.081 (2.05)	1.588	197 lbs	3.30
10	0.102 (2.59)	0.999	314 lbs	5.26
8	0.129 (3.26)	0.628	480 lbs	8.30
6	0.162 (4.11)	0.395	760 lbs	13.30
4	0.204 (5.19)	0.249	1210 lbs	21.15
2	0.258 (6.54)	0.156	1930 lbs	33.62
1	0.289 (7.35)	0.124	2430 lbs	42.41
0 (1/0)	0.325 (8.25)	0.098	3060 lbs	53.49
00 (2/0)	0.365 (9.27)	0.078	3860 lbs	67.43
000 (3/0)	0.410 (10.4)	0.062	4860 lbs	85.01
0000 (4/0)	0.460 (11.68)	0.049	6120 lbs	107.22

4.4 Batteries

4.4.1 Battery Life

The VertaMax can draw lots of amps from your battery when operating. If you are using it for extended periods of time, you will want to recharge occasionally to maintain the charge in the

battery. In addition, the power inverter will also draw a small current, less than 600mA, when turned off and not operating. Therefore, it should be disconnected from your battery if it will not be used for more than a day. The following chart shows typical operation time for typical batteries for various loads.

Power Usage	Current @ 12V	50A/h Battery Operating Time	100A/h Battery Operating Time
100 watt	9 Amps	5.5 hours	11 hours
200 watt	19 Amps	2.6 hours	5.2 hours
500 watt	47 Amps	1 hour	2 hours

*All Values are approximate

4.4.2 Battery State of Charge (SOC)

You can measure battery state of charge with a hydrometer or approximate state of charge with a voltmeter. Using a digital voltmeter that can display tenths or hundredths of a volt, measure the battery when it has not been charged or discharged for several hours.
For a deep-cycle battery at 77º F (25º C), use the following table:

Battery Voltage	State of Charge
12.7 – 13.0 V	100%
12.5 – 12.6 V	80%
12.3 – 12.4 V	60%
12.1 – 12.2 V	40%
11.9 – 12.0 V	20%

4.4.3 Actual Battery Current Draw

Approximate 12 volt current draw is the AC load in watts divided by 10. Thus a 60 watt light bulb plugged into the inverter will cause the inverter to draw 6 amps (60 / 10 = 6) from the 12 volt power supply (e.g. battery).

Batteries are rated in several different ways:

- Peak cranking amps - This has little to do with how long an inverter can supply power, so it is not a useful number for inverter operation.
- Battery reserve capacity - This number shows how long a battery can supply a given current, typically 25 amps, before the battery voltage reaches a low voltage. Therefore, a battery rated at 200 minutes reserve can deliver 25 amps for 200 minutes before it is discharged. Ampere-hour capacity - This rating indicates how many amps a battery can deliver over a period of time, typically 20 hours. Therefore, a 100 amp-hour battery can deliver 5 amps for 20 hours (5 x 20 = 100).

Actual operating time from a battery will depend upon the current draw from the battery. A battery will deliver less total power (energy) as you draw higher amps. A 100 amp-hour battery can deliver 5 amps for 20 hours (100 amp-hours) but it will only deliver 50 amps for 1 1/2 hours (50 x 1.5 = 75) or 75 amp-hours at the higher rate.

Also remember, battery life is decreased if the battery is discharged fully. Lead acid batteries have the longest life, if they are kept fully charged.

4.4.4 Battery Capacity

Select a battery or system of batteries that will provide your Inverter with proper DC voltage and an adequate amp-hour capacity to power your application. Even though VertaMax Inverters are highly efficient at DC-to-AC inversion, their rated output capacities are limited by the total amp-hour capacity of connected batteries and the support of charging devices connected to the battery (e.g. a vehicle alternator, solar panel, wind turbine, battery charger).

STEP 1: Determine Total Wattage Required

Add the wattage ratings of all equipment you will connect to your Inverter. Wattage ratings are usually listed in equipment manuals or on nameplates. If your equipment is rated in amps, multiply that number times AC utility voltage to determine watts. (Example: a ¼ in. drill requires 2½ amps. 2½ amps × 120 volts = 300 watts.)

Note: Your Inverter will operate at higher efficiencies when used at about 75% - 80% of the inverter's rating.

STEP 2: Determine DC Battery Amps Required
Divide the total wattage required (from step 1, above) by the battery voltage (12) to determine the DC amps required.

STEP 3: Estimate Battery Amp-Hours Required
Multiply the DC amps required (from step 2, above) by the number of hours you estimate you will operate your equipment exclusively from battery power before you have to recharge your batteries. Compensate for inefficiency and wiring losses by multiplying this number by 1.2. This will give you a rough estimate of how many amp-hours of battery power (from one or several batteries) you should connect to your Inverter.
NOTE: Battery amp-hour ratings are usually given for a 20-hour discharge rate. Actual amp-hour capacities are less when batteries are discharged at faster rates. For example, batteries discharged in 55 minutes provide only 50% of their listed amp-hour ratings, while batteries discharged in 9 minutes provide as little as 30% of their amp-hour ratings.
You must allow your batteries to recharge long enough to replace the charge lost during Inverter operation or else you will eventually run down your batteries.

5 TROUBLESHOOTING AND SUPPORT

The VertaMax is ruggedly constructed and requires minimal care. It is recommended to inspect all the connections at least two times per year for insulation damage or corrosion and to frequently ensure all connections are tight and secure.

5.1 MAINTENANCE & CARE

- Clean the heat sink and area around the inverter of any dirt or debris with a moistened cloth.
- Tighten the screws on the DC input terminals.
- Be sure vents and fans are free of dust or debris.
- Inspect any batteries for cracked or bulging cases and corroded terminals.

5.2 TROUBLESHOOTING

Problem	CAUSE	Possible Remedies
No Power, No Indicator	Battery is defective	Replace battery
	Tripped Breaker	Determine cause for breaker tripping and then reset breaker.
	Loose cable connections	Check connections and tighten as necessary
Unit operates for a short period and then turns off	Load is trying to draw too much current	Be sure load is less than rated watts of inverter. Remove excessive load. Turn inverter off and back on to reset.
Alarm sounds.	Low voltage	Shorten battery cables or use thicker battery cables. Recharge battery.
	Over Temperature Protection	Allow unit to cool. Improve air circulation around unit. Locate unit to a cooler environment. Reduce load if continuous operation is required
	Overload	Reduce load or use a larger inverter
	Bad Connections	Check all connections and tighten as needed.
Measured inverter output voltage is too low.	Modified sine waves may read incorrectly on typical multi-meters	Inverter's "modified sine wave" output requires "true RMS" voltmeter for accurate measurements
	Battery voltage is too low	Recharge battery
	Over load	Reduce the load

Battery run time is less than expected	AC product's power consumption is higher than rated	Use a larger battery to make up for increased power requirement
	Battery is old or defective	Replace battery.
	Battery is not being properly charged	Some chargers are not able to fully recharge a battery. Make sure you use a powerful charger.
	Power dissipation in DC cables.	Use shorter/thicker DC cables.
Television and/or stereo interference	Audio/Video interference.	Reposition equipment antennas and Inverter. Position the power inverter and wiring as far as possible from electronic equipment, antenna and cables. Make sure the chassis ground connection on the inverter is solidly connected. Keep battery cables as short as possible and twist them together (2-3x per foot).

5.3 SUPPORT

If you are experiencing technical problems, and cannot find a solution in this manual, you can contact Windy Nation Inc. for further assistance.

- Call: (805) 323-6445
- Email: info@windynation.com
- Write: 398 South Ash Street, Unit C, Ventura, CA 93001

For challenging issues or to just ask a question, consider using our FREE Community Forums! Consult our community of DIY'ers for fast answers to all your questions.

Post on our Forums: http://www.windynation.com/community/

5.4 WARRANTY

Windy Nation warrants that the Power Inverter (the "Product"), will be free from manufacturing defects in materials and workmanship under normal authorized use consistent with product instructions for a period of one (1) year from the date the original purchaser ("Customer") receives the Product (the "Warranty Period"). This warranty extends only to the original purchaser. The Customer's sole and exclusive remedy and the entire liability of Windy Nation, its suppliers and affiliates for breach of the warranty is, at Windy Nation's option, either (i) to replace the Product (or defective component part(s)) with a new or reconditioned Product (or component part(s)); (ii) to repair the reported problem; or (iii) to refund the purchase price of the Product. Repaired or replaced products are warranted for the remainder of the original warranty period only. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Windy Nation not expressly set forth in this limited warranty.

5.4.1 Restrictions

No warranty will apply if the Product (i) has been altered or modified except by Windy Nation; (ii) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by Windy Nation; (iii) has been subjected to abnormal physical, thermal or electrical stress, misuse, negligence, or accident. If Windy Nation determines that the problem with the Product is not due to a manufacturing defect in Windy Nation's workmanship or materials, or otherwise does not qualify for warranty repair, then the Customer will be responsible for the costs of all necessary repairs and expenses incurred by Windy Nation.

5.4.2 Warranty Claims & Return Procedures

To be eligible for service under this warranty, the Customer must submit a service request within the Warranty Period by contacting Windy Nation in writing or via telephone and obtaining a Returned Materials Authorization ("RMA") number. This RMA must be obtained before returning any product under this warranty. Notification must include a description of the alleged defect, the manner in which the Product was used, the serial number, and the original purchase date in addition to the name, address, and telephone number of the Customer. Within five (5) business days of the date of notification, Windy Nation will provide the Customer with an RMA number and the location to which the Customer must return the defective Product. Any Product returned for warranty service shall be shipped at the expense and risk of the Customer. The Customer must return the entire Product kit (or, if authorized by Windy Nation, the defective component parts), within fifteen (15) days after issuance of the RMA number. Windy Nation will be under no obligation to accept any returned Product that does not have a valid RMA number. Customer's failure to return the Product within fifteen (15) days of its receipt of an RMA number may result in cancellation of the RMA. All parts that Windy Nation replaces shall become Windy Nation's property on the date Windy Nation ships the repaired Product or part back to the Customer. Windy Nation will use all reasonable efforts within thirty (30) days of receipt of the defective Product to repair or replace such Product. If a warranty claim is invalid for any reason, the Customer will be charged at Windy Nation's then-current rates for services performed and will be charged for all necessary repairs and expense incurred by Windy Nation. If Windy Nation determines that a warranty claim is valid, it will ship the repaired or replaced Product to Customer at Windy Nation's cost.

5.4.3 Disclaimer

EXCEPT FOR THE EXPRESS LIMITED WARRANTY SET FORTH IN THE PREVIOUS PARAGRAPH, WINDY NATION DISCLAIMS ALL WARRANTIES, EXPRESS, IMPLIED AND STATUTORY INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS PROVIDED BY WINDY NATION. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY WINDY NATION, ITS DEALERS, DISTRIBUTORS, AGENTS OR EMPLOYEES SHALL IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY. WINDY NATION DOES NOT WARRANT THAT THE QUALITY OR PERFORMANCE OF THE PRODUCTS WILL MEET YOUR REQUIREMENTS OR THAT YOU WILL BE ABLE TO ACHIEVE ANY PARTICULAR RESULTS FROM USE OR MODIFICATION OF THE PRODUCTS. Some jurisdictions do not allow the limitation or exclusion of implied warranties or how long an implied warranty may last, so the above limitations may not apply to you. In any such jurisdiction, the warranty shall be limited to the minimum warranty and period required by law.

WINDY NATION EXPRESSLY DISCLAIMS ALL LIABILITY FOR BODILY INJURIES OR DEATH THAT MAY OCCUR, DIRECTLY OR INDIRECTLY, BY USE OF THE PRODUCT BY ANY PERSON.

5.4.4 Limitation of Liability

UNDER NO CIRCUMSTANCES WILL WINDY NATION OR ITS AFFILIATES OR SUPPLIERS BE LIABLE OR RESPONSIBLE FOR ANY LOSS OF USE, INTERRUPTION OF BUSINESS, LOST PROFITS, LOST DATA, OR INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL

DAMAGES OF ANY KIND REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, EVEN IF WINDY NATION OR ITS AFFILIATE OR SUPPLIER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so these limitations may not apply to you. Neither Windy Nation nor its affiliates or suppliers will be held liable or responsible for any damage or loss to any items or products connected to, powered by or otherwise attached to the Product. The total cumulative liability to Customer, from all causes of action and all theories of liability, will be limited to and will not exceed the purchase price of the Product paid by Customer. This warranty gives the Customer specific legal rights and the Customer may also have other legal rights that vary from state to state.